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By K B Hemanth Raj

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CELLULAR MOBILE COMMUNICATIONS

B.E., VI Semester, Electronics & Communication Engineering/ Telecommunication Engineering
[As per Choice Based Credit System (CBCS) Scheme]

Course Code	**17EC651**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours / Module)**	**Exam Hours**	**03**

CREDITS – 03

Course Objectives: This course enables students to:

- Understand the application of multi user access in a cellular communication scenario.
- Understand the propagation mechanisms in an urban mobile communications using statistical and empirical models.
- Understand system architecture, call processing protocols and services of GSM, GPRS and EDGE.
- Understand system architecture, call processing protocols and services of CDMA based systems IS95 and CDMA2000.

Module-1

Cellular Concept: Frequency Reuse, Channel Assignment Strategies, Interference and System Capacity, Power Control for Reducing Interference, Trunking and Grade of Service, Improving Capacity in Cellular Systems.

Mobile Radio Propagation: Large Scale path Loss- Free Space Model, Three basic propagation mechanisms, Practical Link Budget Design using Path Loss Models, Outdoor Propagation Models – Okumura, Hata, PCS Extension to Hata Model (explanations only) (Text 1). **L1, L2**

Module-2

Mobile Radio Propagation: Small-Scale Fading and Multipath:

Small scale Multipath Propagation, Impulse Response Model of a Multipath Channel, Small-Scale Multipath Measurements, Parameters of Mobile Multipath Channels, Types of Small-Scale Fading, Rayleigh and Ricean Distributions, Statistical Model for Multipath Fading Channels (Clarke's Model for Flat Fading only). (Text 1) **L1, L2**

Module-3

System Architecture and Addressing:

System architecture, The SIM concept, Addressing, Registers and subscriber data, Location registers (HLR and VLR) Security-related registers (AUC and EIR), Subscriber data, Network interfaces and configurations.

Air Interface – GSM Physical Layer:

Logical channels, Physical channels, Synchronization- Frequency and clock synchronization, Adaptive frame synchronization, Mapping of logical onto physical channels, Radio subsystem link control, Channel coding, source coding and speech processing, Source coding and speech processing, Channel coding, Power-up scenario.

GSM Protocols:

Protocol architecture planes, Protocol architecture of the user plane, Protocol architecture of the signaling plane, Signaling at the air interface (Um), Signaling at the A and Abis interfaces, Security-related network functions, Signaling at the user interface .(Text 2) **L1, L2**

Module-4

GSM Roaming Scenarios and Handover:
Mobile application part interfaces, Location registration and location update, Connection establishment and termination, Handover. (up to 6.4.1 only in Text2)

Services:
Classical GSM services, Popular GSM services: SMS and MMS.

Improved data services in GSM: **GPRS, HSCSD and EDGE**
GPRS System architecture of GPRS , Services , Session management, mobility management and routing, Protocol architecture, Signaling plane, Interworking with IP networks, Air interface, Authentication and ciphering, Summary of GPRS .
HSCSD: Architecture, Air interface, HSCSD resource allocation and capacity issues.
EDGE: The EDGE concept, EDGE physical layer, modulation and coding, EDGE: effects on the GSM system architecture, ECSD and EGPRS. (Text 2) **L1, L2**

Module-5

CDMA Technology – Introduction to CDMA,CDMA frequency bands, CDMA Network and System Architecture, CDMA Channel concept, Forward Logical Channels, Reverse logical Channels, CDMA frame format, CDMA System Operations(Initialization/Registration), Call Establishment, CDMA Call handoff,IS-95B,CDMA2000,W-CDMA,UMTS,CDMA data networks, Evolution of CDMA to 3G, CDMA 2000 RAN Components, CDMA 2000 Packet Data Service. (Text 3) **L1, L2**

Course outcomes: At the end of the course, the students will be able to:

- Apply the understanding of statistical characterization of urban mobile channels to compute the performance for simple modulation schemes.
- Demonstrate the limitations of GSM, GPRS and CDMA to meet high data rate requirements and limited improvements that are needed.
- Analyze the call process procedure between a calling number and called number for all scenarios in GSM or CDMA based systems.
- Test and validate voice and data call handling for various scenarios in GSM and CDMA systems for national and international interworking situations.

Text Books:

1. Theodore Rapport, “Wireless Communications – Principles and Practice”, Prentice Hall of India , 2nd Edition, 2007, ISBN 978-8-120-32381-0.
2. Jorg Eberspacher, Hans-Jorg Vogel, Christian Bettstetter, Christian Hartmann, "GSM– Architecture, Protocols and Services”, Wiley,3rd Edition, 2009,ISBN-978-0-470-03070-7.
3. Gary J Mullet, “Introduction To Wireless Telecommunications Systems and Networks", Cengage Learning.